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(54) **ADDITIVE INJECTING APPARATUS AND LAUNDRY TREATMENT MACHINE INCLUDING THE SAME**

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(51) **Int. Cl.**

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D06F 39/08	(2006.01)
D06F 58/20	(2006.01)

(52) **U.S. Cl.**

CPC ***D06F 39/02*** (2013.01); ***D06F 39/008*** (2013.01); ***D06F 39/022*** (2013.01); ***D06F 39/088*** (2013.01); ***D06F 58/20*** (2013.01); ***D06F 58/203*** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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(57) **ABSTRACT**

Provided are an additive injection apparatus and a laundry treatment machine including the same. The additive injection apparatus includes a main body, and additive container, a nozzle, and a floater. The main body is disposed on a path along which a solvent flows and includes an inlet and an outlet for receiving and discharging the solvent, respectively. The additive container holds an additive. The nozzle has a communicating hole for communicating between the main body and the additive container. The floater is disposed in the main body, and rises and falls according to the flow of the solvent to open and close the communicating hole.

20 Claims, 9 Drawing Sheets

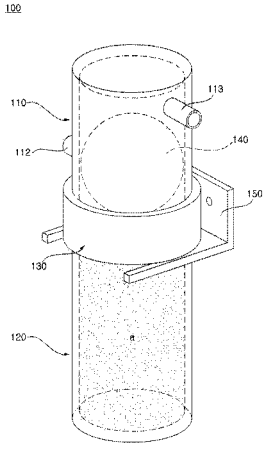


FIG. 1

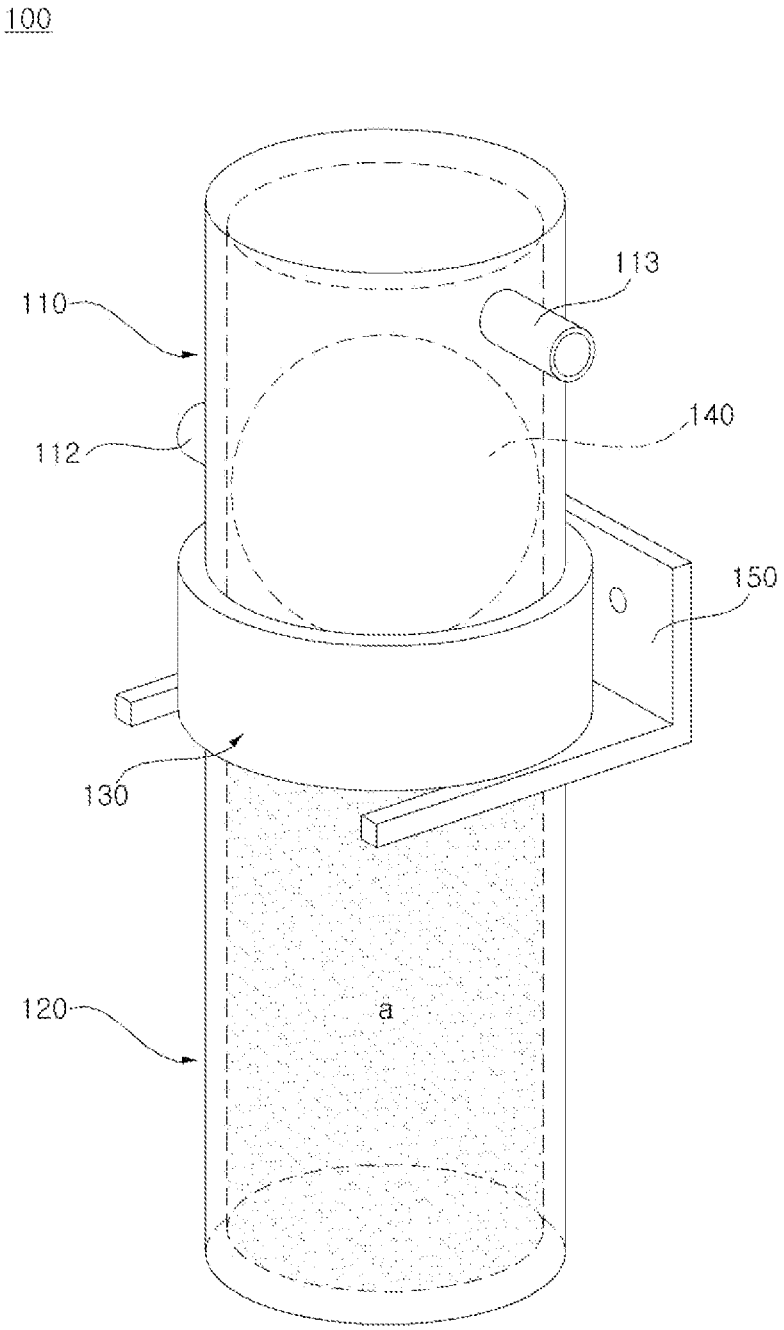


FIG. 2

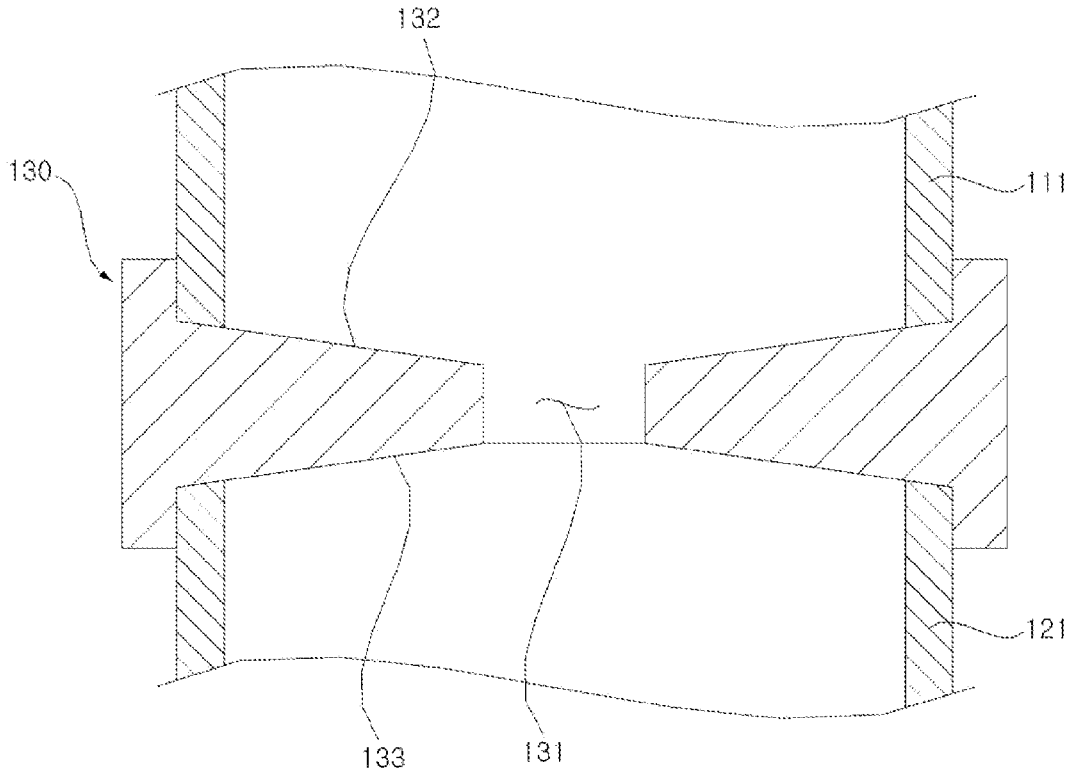


FIG. 3A

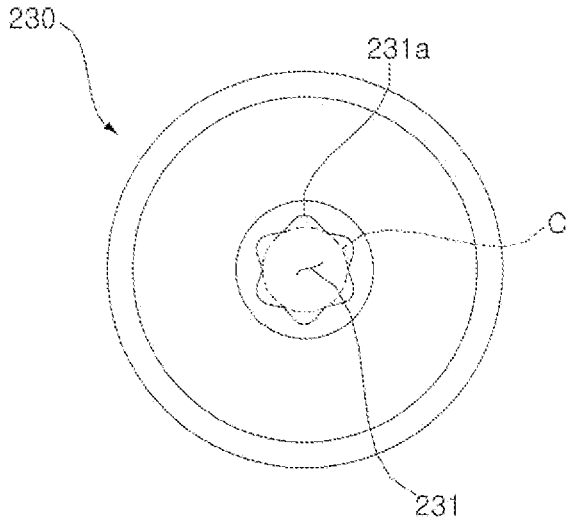


FIG. 3B

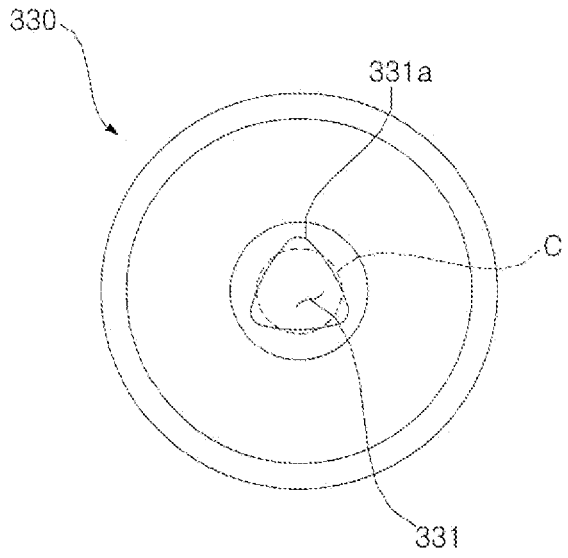


FIG. 3C

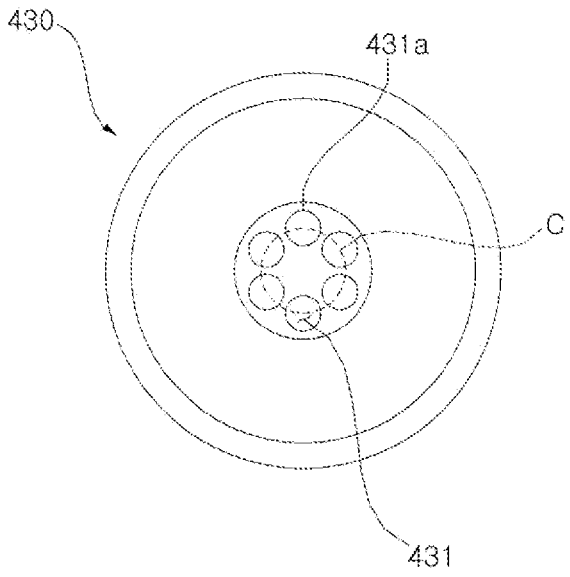


FIG. 3D

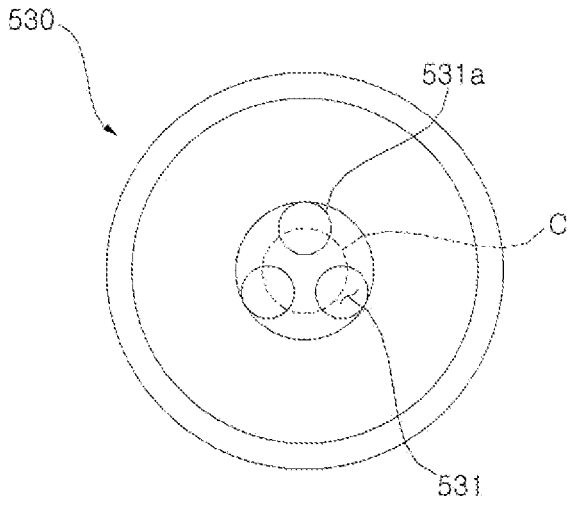


FIG. 4

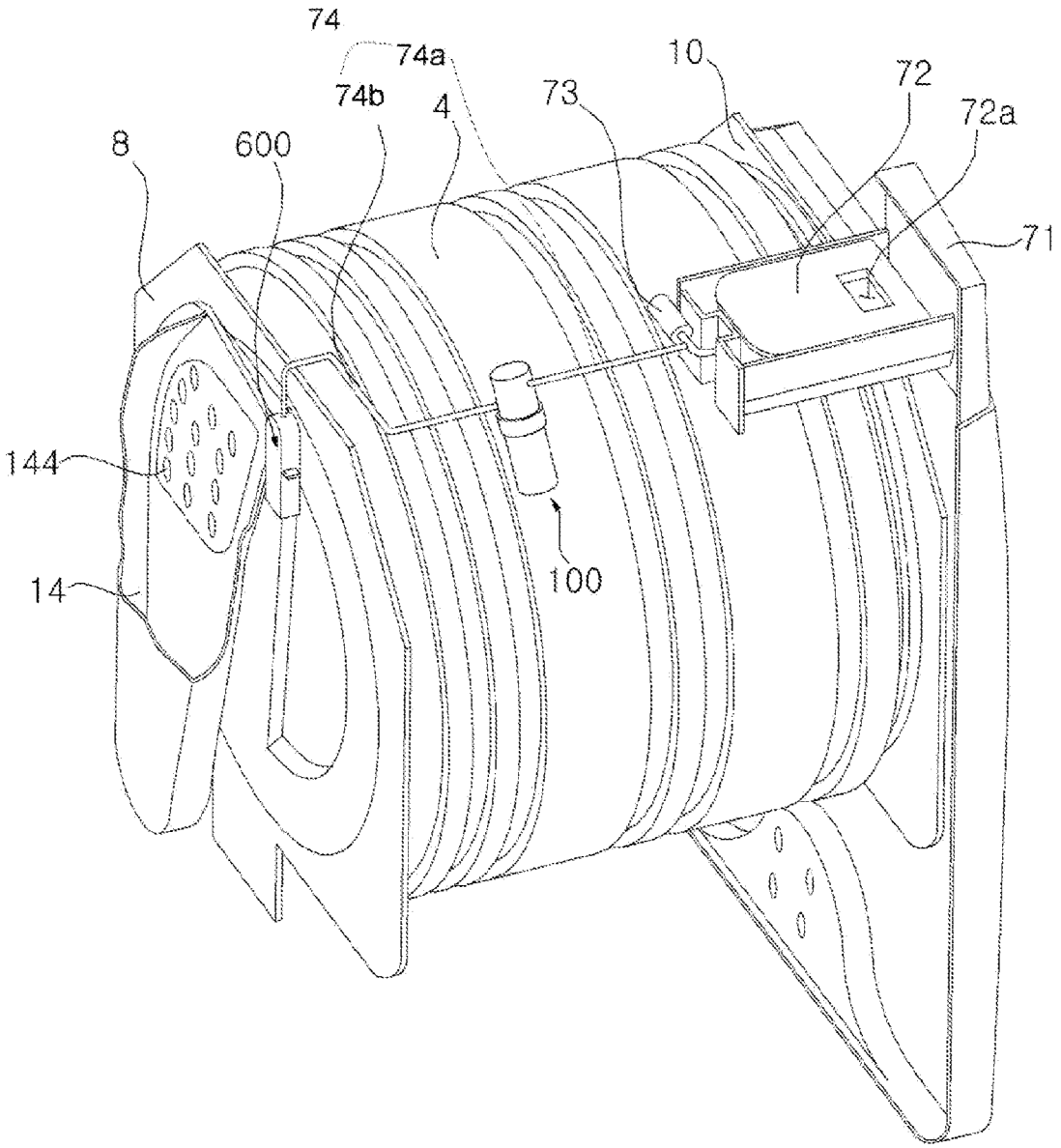


FIG. 5

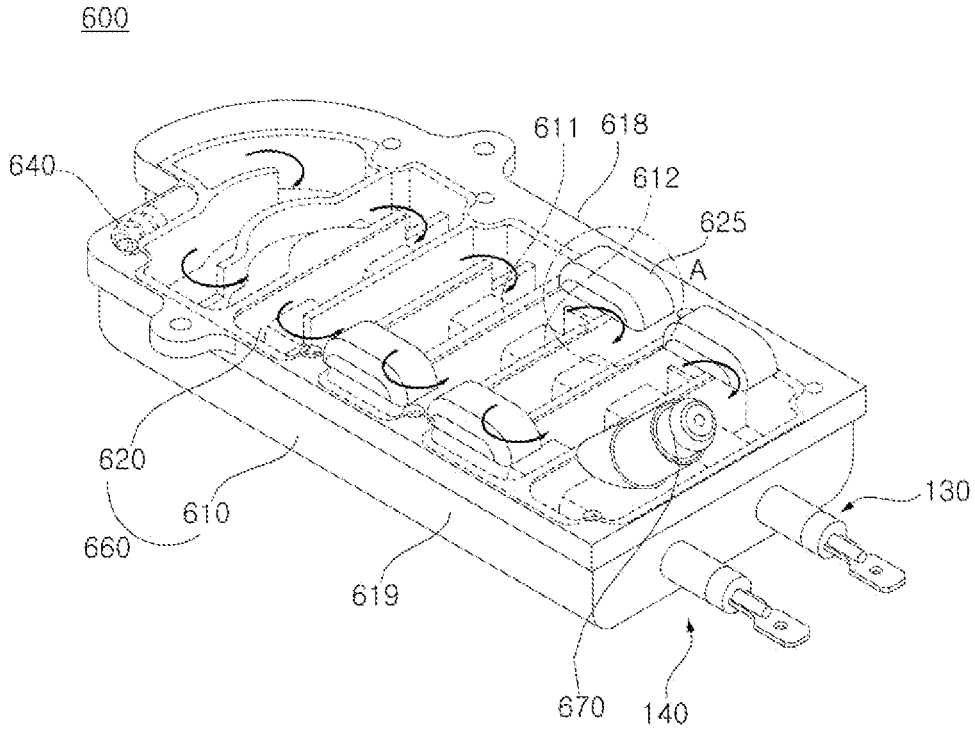
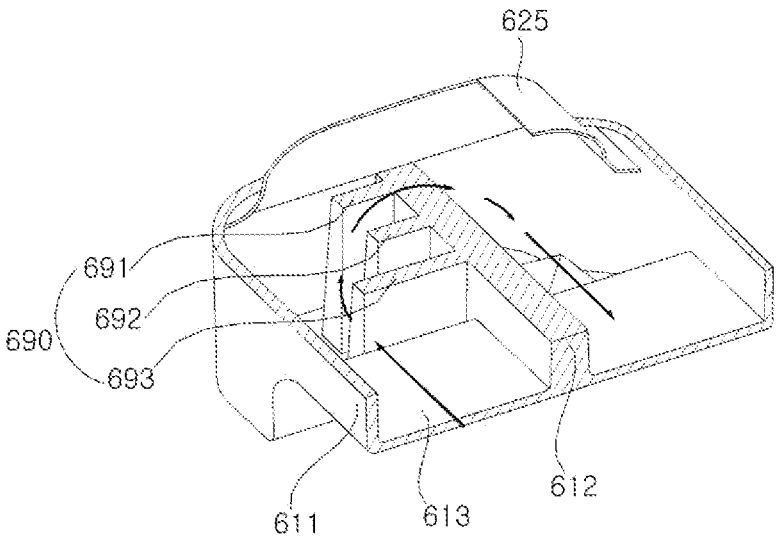


FIG. 6



ADDITIVE INJECTING APPARATUS AND LAUNDRY TREATMENT MACHINE INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application claims priority under 35 U.S.C. §119 to Korean Application No. 10-2012-0097837 filed on Sep. 4, 2012, whose entire disclosure is hereby incorporated by reference.

BACKGROUND

1. Field

The present application relates to an additive injecting apparatus and a laundry treatment machine including the additive injection apparatus.

2. Background

Generally, an additive injecting apparatus is an apparatus that injects an additive to a solvent. For example, solvents such as water, alcohol, benzene, acetone, and ether are used in laundry treatment machines such as washing machines, drying machine, washing & drying machines, and refreshers which perform washing, rinsing, drying, and refreshing cycles on laundry such as clothing and bedding. Recently, laundry treatment machines with an additional function of spraying steam generated by heating a solvent are being widely used. Laundry can be treated according to the characteristics of the additives by injecting a certain additive to the solvents. Additives can be provided in a form of water-soluble or oil-soluble liquid or powder according to the characteristics of the solvents.

Examples of additives include additives for washing such as detergent, fabric softener, and bleach, anti-scale agent for preventing scale from being generated on a flow path of a solvent, air freshener, anti-rust additive, oxidizing/reducing agent for maintaining an appropriate level of PH, sterilizer, and dispersing agent.

These additives can be injected at a time, but needs to be uniformly injected little by little in accordance with their purpose. For example, since the anti-scale agent needs to continuously act on the movement path of the solvent, it is more important to inject the anti-scale agent little by little than inject a large amount of anti-scale agent at a time.

The above references are incorporated by reference herein where appropriate for appropriate teachings of additional or alternative details, features and/or technical background.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

FIG. **1** is a view illustrating an additive injecting apparatus according to an embodiment of the present application;

FIG. **2** is a view illustrating an exemplary nozzle part shown in FIG. **1**;

FIGS. **3**A through **3**D are views illustrating other exemplary nozzle parts;

FIG. **4** is a view illustrating a laundry treatment machine according to an embodiment of the present application;

FIG. **5** is a view illustrating a spray apparatus shown in FIG. **4**; and

FIG. **6** is a cross-sectional view illustrating a portion A of FIG. **5**.

DETAILED DESCRIPTION

FIG. **1** is a view illustrating an additive injecting apparatus according to an embodiment of the present application. FIG. **2** is a view illustrating an exemplary nozzle part shown in FIG. **1**.

Referring to FIG. **1**, an additive injecting apparatus **100** according to an embodiment of the present application may include a main body **110** including an inlet **112** and an outlet **113** for receiving and discharging a solvent, respectively, an additive container **120** for holding an additive, a nozzle **130** including a communicating hole **131** for communicating between the main body **110** and the additive container **120**, and a floater **140** disposed in the main body **110** to open or close the communicating hole **131** by rising and falling according to the flow of the solvent.

The additive injection apparatus **100** may inject the additive into the solvent flowing along a certain flow passage. For example, laundry treatment machines such as washing machines, drying machines, washing & drying machines, and refreshers may include a solvent supply passage (see supply pipe **74** of FIG. **4**) for supplying an organic solvent for dry cleaning or spot removal or water to clothing or bedding (hereinafter, referred to as laundry) that is a target to be treated. The additive injection apparatus **100** may be disposed on the solvent supply passage. Thus, while the solvent is flowing along the solvent supply passage, the additive may be injected. The additive may be appropriately injected according to the treatment purpose of laundry. For example, the additives may include anti-scale agent, detergent, fabric softener, bleach, oxidizing/reducing agent for maintaining an appropriate level of PH, sterilizer, dispersing agent, and surfactant. The injected additive may have appropriate liquid properties such as water solubility, oil solubility, acidity, alkalinity, and neutrality, and may have morphological characteristics of liquid, particle, or the like (see a of FIG. **1**).

The main body **110** may receive a solvent through the inlet **112** connected to the solvent supply passage, and may discharge the solvent through the outlet **113**. In this case, the floater **140** may be raised by a stream pressure, allowing the communicating hole **131** to be opened. The center point of the inlet **112** for receiving the solvent is located at a horizontal level below the center of the floater **140**. In this case, a portion of the solvent may be introduced into the additive container **120**, and may dissolve the additive. Solvent with the additive dissolved may be supplied to the main body through the communicating hole **131**. This process may be mainly performed by a diffusion action due to a concentration gradient between the main body **110** and the additive container **120**. However, the additive may maintain an appropriate difference of the specific gravity from the solvent. Thus, the additive may have a specific gravity greater than that of the solvent such that the additive stays in the additive container **120** until the dissolution between the additive and the solvent is performed. Herein, the specific gravity is defined as the ratio of the weight of a volume of a substance to the weight of an equal volume of distilled water at 4° C.

The additive held in the additive container **120** may have a particle size smaller than the area of the communicating hole **131**, or although the additive is liquid, the whole amount of additive is not used up at a time. This is because it is possible to maintain the amount transferred from the additive container **120** to the main body **110** through the communicating hole **131** relatively smaller than the discharge amount of the outlet **113**, by appropriately adjusting the pressure of solvent

received through the inlet, the flow rate of solvent passing the inlet **112** or the outlet **113**, and the area of the communicating hole **131**.

The floater **140** may smoothly rise due to the buoyancy when the specific gravity of the floater **140** is smaller than the solvent. However, in this case, even when the solvent supply is stopped, the floater **140** may be maintained at a raised state by a residual solvent in the solvent supply passage or the main body **110**, causing the additive to be excessively spent. Accordingly, the specific gravity of the floater **140** may be allowed to be larger than that of solvent such that the floater **140** can be maintained to close the communicating hole **131** at the falling location if the solvent does not flow even though the solvent is filled in the main body **110**. When the solvent is water, the floater **140** may be formed of a material, e.g., synthetic resin such as polycarbonate (PC) or acrylonitrile-butadiene-styrene copolymer (ABS) having a specific gravity larger than water.

The inlet **112** may be formed at a location lower than that of the outlet **113**. In this case, due to a height difference between the inlet **112** and the outlet **113**, a certain degree of rising stream may be formed to allow the floater **140** to smoothly rise.

The reference numeral **150** indicates a coupling bracket. The coupling bracket **150** may fix the additive injection apparatus **110** to the casing or the like.

Referring to FIG. **2**, the nozzle **130** may include an inclination forming part **132** that inclines toward the communicating hole **131** such that the floater **140** can be located just on the communicating hole **131** when falling. When the solvent supply is stopped, the floater **140** may be downwardly converged to the communicating hole **131** along the inclination forming part **132**, interrupting the injection of the additive.

Meanwhile, the nozzle **130** may include a convergent part **133** forming an inclination surface that converges to the communicating hole **131** such that dissolved components in the additive container **120** can be smoothly guided to the communicating hole **131** together with the solvent. In a structure in which the main body **110** is located over the additive container **120**, the convergent part **133** may be formed at the lower portion of the nozzle, i.e., at the opposite side of the inclination forming part **132**.

FIGS. **3**A through **3**D are views illustrating other exemplary nozzles. Hereinafter, nozzles according to other embodiments will be described with reference to FIGS. **3**A to **3**D.

In the above description, it should be understood that the closed state of the floater **140** with respect to the communicating hole **131** at the falling location does not necessarily mean a fully sealed state of the communicating hole **131**, and may include a case where a certain gap exists between the floater **140** and the communicating hole **131**. Particularly, in order to allow the solvent to quickly flow into the additive container **120** at an initial stage of solvent supply, it is desirable that a certain gap exists between the floater **140** and the communicating hole **131** even when the floater **140** is located at the falling location. In another aspect, this structure may contribute to smooth rising of the floater **140** by reducing the contact area between the floater **140** and the communicating hole **131** and thus reducing the viscous frictional force between the floater **140** and the communicating hole **131**.

For this, the communicating hole **131** may include non-contact sections **231***a*, **331***a*, **431***a* and **531***a* with the floater **140** at the falling location of the floater **140**. At the falling location of the floater **140**, the additive container **120** and the main body **110** may communicate with each other through the non-contact section **231***a*, **331***a*, **431***a* and **531***a*. FIGS. **3**A to **3**D show that gaps exist between the section C of the floater **140** and the non-contact sections **231***a*, **331***a*, **431***a* and **531***a* over the same position plane as the communicating hole **131**.

According to embodiments, the floater **140** may have a spherical shape, and the communicating hole **131** may be non-circular to reduce the contact area with the floater **140** (see FIGS. **3**A and **3**B).

Referring to FIGS. **3**C and **3**D, the communicating hole **131** may be formed in plurality. Since the floater **140** is also supported between the communicating holes **131**, the floater **140** may not adhere fully to the communicating hole **131**. Accordingly, compared to a case where the communicating hole **131** is formed in singularity, the non-contact sections **431***a* and **531***a* can increase.

FIG. **4** is a view illustrating a laundry treatment machine according to an embodiment of the present application. FIG. **5** is a view illustrating a spray apparatus shown in FIG. **4**. FIG. **6** is a cross-sectional view illustrating a portion A of FIG. **5**.

Referring to FIGS. **4** to **6**, a laundry treatment machine (hereinafter, exemplified as a drying machine, but embodiments are not limited thereto) according to an embodiment of the present application may include a drum **4** rotatably disposed therein and holding laundry and a spray apparatus **600** spraying water into the drum **4**.

The spray apparatus **600** may include a flow passage forming unit **660** comprising a flow passage guiding water introduced through the inlet **613** to a nozzle **670**, a steam generating heater **630** applying heat to water flowing along the flow passage forming unit **660**, and the nozzle **670** spraying heated water in addition to steam generated while water is flowing along the flow passage in the flow passage forming unit **660**.

In this embodiment, a separate water receiver **72** may be provided, and an additive injection apparatus **100** may be disposed on a water supply pipe **74** connected to the water receiver **72**. The inlet **112** of the additive injection apparatus **100** may receive water from the water receiving unit **72** through a water supply pipe **74***a*, and the outlet **113** of the additive injection apparatus **100** may be connected to the spray apparatus **600** through a water supply pipe **74***b*. A pump **73** may be provided on the water supply pipe **74***a* to forcibly transfer water from the water receiving unit **72** to the additive injection apparatus **100**.

On the other hand, the flow passage forming unit **660** may also be supplied with water from an external water source such as a faucet. In this case, a water supply hose connected to the external water resource may be connected to the inlet **112** of the solvent injection apparatus **600**, and a valve may be further provided between the inlet **112** and the water supply hose to control water supply. A filter may be further provided to filter foreign substances from supplied water.

The flow passage forming unit **660** may be integrally coupled to the nozzle **670**. Here, the meaning of the integral coupling may include a case where the flow passage forming unit **660** and the nozzle **670** are formed into one member by injection molding as well as a case where the flow passage forming unit **660** and the nozzle **670** are separately formed and then form one unit or module. In either case, the location of the nozzle **670** may be determined by the fixed location of the flow passage forming unit **660**.

A typical structure in which water is held and heated in a certain container to generate steam and the steam is transferred to the spray nozzle through the hose has a limitation in that the steam can be condensed and the condensate water can be sprayed through the nozzle, wetting the drying subject again. However, according to an embodiment of the present application, water may be heated while flowing through the flow passage unit **660**, and steam may be sprayed through the

nozzle **670** formed integrally with the flow passage forming unit **660**. Accordingly, it can be fundamentally prevented that steam is condensed while steam generated in the flow passage forming unit **660** is flowing to the nozzle **670**.

The water receiving unit **72** may be disposed in the drawer **71**. A user may withdraw the drawer **71**, and may supply water through a loading hole **72***a*. Particularly, in case of a laundry treatment machine miniaturized in consideration of mobility, it is advantageous to receive water through the water receiving unit **72** rather than receive water from an external water source.

The flow passage forming unit **660** may include a flow passage main body **610** and a cover **620**. The flow passage main body **610** may include a flow passage for guiding water from the inlet **613** to the nozzle **670**, and may have an upper portion opened. The cover **620** may cover the opened upper portion of the flow passage main body **610**. According to embodiments, the flow passage main body **610** and the cover **620** may be integrally formed. The flow passage main body **610** may have the inlet **613** connected to the water supply pipe **74**. Water may be introduced into the flow passage main body **610** through the inlet **613**.

The steam generating heater **630** may heat water introduced into the flow passage main body **610**. Water may be heated to generate steam according to the heating of the steam generating heater **630**. The steam generating heater **630** may be exposed to the flow passage in which water flows, but in this embodiment, will be exemplified as being buried in a bottom **613** of the flow passage main body **610**. Since the steam generating heater **630** is not directly exposed to water, there is an advantage in that a separate insulating structure for the insulation of the steam generating heater **630** is unnecessary. The flow passage main body **610** may be formed of a thermal conductive material such as aluminum, such that heat transfer from the steam generating heater **630** can be easily performed.

The steam generating heater **630** may include two terminals **631** and **632** for power supply. The terminals **631** and **632** may outwardly protrude from the flow passage main body **610** to be electrically connected to a power supply.

The flow passage main body **610** may form a certain space such that water can be moved to the inside thereof. A plurality of flow passage forming ribs **611** and **612** may be protrusively formed on the bottom **613** of the flow passage main body **610** to form a path along which water moves. The plurality of flow passage forming ribs may extend between a right side portion **118** and a left side portion **119** of the flow passage main body **610**.

Water supplied through the inlet **613** may be guided along the plurality of flow passage forming ribs **611** and **612**. The traveling direction of water may be alternately switched while flowing to the nozzle **670**.

The cover **620** may cover the flow passage main body **610**, and may be formed integrally with the flow passage main body **610** or may be coupled to the flow passage main body **610** by a coupling member. In this case, sealing may be performed between the cover **620** and the flow passage main body **610** such that steam generated in the flow passage main body **610** is not leaked.

An outlet may be formed on the cover **620** to discharge water flowing along the flow passage forming ribs **611** and **612**. The outlet may be coupled to nozzle **670**.

Meanwhile, the flow passage forming unit **660** may include a plurality of flow passage forming ribs **611** and **612** protruding from the bottom **613**, and may be divided into both spaces based on one of the flow passage forming ribs **611** and **612**. Also, the passage forming unit **660** may have a gap for movement of water at an upper side of the flow passage forming rib **612** such that water can overflow the flow passage forming rib **612** while traveling from one of the both spaces pertaining to upstream side to the other space pertaining to downstream side. In order to provide the gap for the movement of water, a gap forming section **625** may be formed in the cover **620**. In the gap forming section **625**, the inner side surface of the cover **620** may be spaced from the flow passage forming rib **612**.

An impactor **690** may be provided in the flow passage forming unit **660**, and may extend from the flow passage forming rib **612**. The impactor **690** may protrude in plurality toward the space pertaining to the upstream side among the both spaces based on the flow of water.

The impactor **690** may be formed at a location corresponding to the gap forming section **625**. Water flowing in the flow passage forming unit may be hit by the impactor **690** at the space pertaining to the upstream side of the both spaces divided by the flow passage forming rib **612**, and then may travel to the space pertaining to the downstream side through the gap forming section **625**. When this process is continuously repeated, scale may be mainly generated among the impactors **691**, **692** and **693**. Accordingly, the spray hole of the nozzle **670** can be prevented from clogging.

The impactor **690** may be formed at a plurality of locations, particularly, at sections where the flow direction is switched. The flow passage forming rib may be partially cut such that the water flow can travel even though the gap forming section **625** is not formed at a section where the impactor **690** is not installed among the sections where the flow direction is switched.

Although not shown, the spray apparatus **600** may be configured such that the inlet **640** is disposed over the nozzle **670**. This structure is advantageous to discharging of residual water in the flow passage forming unit **660**.

The structure in which the traveling direction of water is alternately switched between the flow passage forming ribs **611** and **612** may apply sufficient heat to water flowing along the flow passage by lengthening the traveling distance of water. Particularly, when comparing with a case where steam is generated by heating water held in a certain place, this embodiment has an effect of significantly reducing time necessary in steam spraying compared to a related art because heat is applied to flowing water and thus the phase change is achieved.

Also, since water is heated while moving along the flow passage forming unit **660**, a portion of water is phase-changed into steam, but another portion of water may reach the nozzle **670** in a liquid state. Accordingly, water sprayed through the nozzle **670** may be in a state that liquefied water and gaseous water (steam) are mixed. Preferably, during the spraying through the nozzle **670**, the temperature at the outlet or the inlet of the nozzle **670** may be maintained at about 70 degrees Celsius (hereinafter, unit of temperature is Celsius), and the internal temperature of the drum **4** may be maintained at a temperature range from about 30 degrees to about 40 degrees. In a typical type in which only steam is spray, since the temperature of steam is too high, clothing may be directly damaged and secondary contamination may occur due to denaturalization of spots. However, in this embodiment clothing is not damaged while a certain level of spray pressure is maintained.

The spray pressure of the nozzle **670** may also be closely related with the diameter of the spray hole of the nozzle **670**. When the diameter of the spray hole is greater than about 1.5 mm, water sprayed from the nozzle **670** may not hit or reach laundry with a sufficient strength. On the other hand, when

the diameter of the spray hole is smaller than about 1 mm, the amount of spray may be insufficient to treat clothing. Also, as the diameter of the spray hole decreases, the possibility of the clogging of the spray hole may increase due to scale. Accordingly, in consideration of various factors, the diameter of the spray hole of the nozzle **670** may range from about 1.5 mm to about 2 mm. In this case, the nozzle **670** may spray water of about 70 cc to about 120 cc per minute.

Also, since water keeps absorbing heat while flowing along a narrow flow passage defined as a gap between the flow passage forming ribs **611** and **612**, when the water flow is divided into upstream and downstream according to the traveling direction from the inlet **640** to the nozzle **670**, downstream water may be prone to phase change due to much heat-absorbing time, and upstream water may also rapidly generate steam at a portion contacting the bottom **613**, where a high temperature and pressure state is generated due to a water pressure according to the flowing of the water in addition to the steam, and a high pressure may act from upstream to downstream. Accordingly, steam finally sprayed through the nozzle **670** may be maintained at a very high pressure, and can reach a drying subject in the drum **4**.

That is, since the spray apparatus **600** can generate and spray steam in a short time, time spent on the steam spray cycle can be reduced, and the power consumption can also be reduced. Also, steam can be sprayed at a high temperature and pressure.

Meanwhile, in the additive injection apparatus **100**, water supplied through the water supply pipe **74** may flow from the inlet **112** to the outlet **113** in the main body **110**. In this process, the floater **140** may rise and thus the additive may be injected. Thus, water with the additive dissolved therein may be supplied to the spray apparatus **600**. As described above, the additive injection apparatus **100** can inject various kinds of additives, and particularly, can inject an anti-scale agent (see a of FIG. **1**) to prevent scale from being generated in the spray apparatus **600**.

The anti-scale agent may include polyphospates and oxygen-binding agent, chelate agent, and dispersion agent, and may include hydroxy etylene diphosphonic acid (HEDP) that precipitates and dissolves Ca and Mg components and adsorbs amorphous precipitate crystals such as needle shape and snowy shape.

As another example, the anti-scale agent may include effect-proven tetrasodium ethylenediaminetetraacetec acid (EDTA) that prevents the generation of scale by precipitating hardness components of solvent, disperses already-generated scale by a strong dispersion action, prevents corrosion by chemically reacting with dissolved oxygen, and maintains an optimum PH by melting alkaline substances.

The additive injection apparatus according to the embodiment of the present application has an effect of injecting an additive to a solvent at a uniform concentration.

Also, since the additive injection apparatus allows an additive to be injected only when a solvent flows, an appropriate amount of additive can be spent only when necessary.

The present application provides an additive injecting apparatus and a laundry treatment machine including the same, which can uniformly inject an additive to a solvent.

The present application also provides an additive injecting apparatus and a laundry treatment machine, which automatically injects additives according to the flow of a solvent.

According to an aspect of the present application, there is provided an additive injection apparatus comprising: a main body disposed on a path along which a solvent flows and comprising an inlet and an outlet for receiving and discharging the solvent, respectively; an additive container holding an additive; a nozzle having a communicating hole for communicating between the main body and the additive container; and a floater disposed in the main body and rising and falling according to the flow of the solvent to open and close the communicating hole.

The main body may be disposed over the additive container.

The floater may have a specific gravity larger than the solvent.

The center point of the inlet for receiving the solvent is located at a horizontal level below the center of the floater.

The nozzle may include an inclination forming part that inclines toward the communicating hole such that the floater downwardly converges to the communicating hole.

The floater may have a spherical shape, and the communicating hole may be non-circular to reduce a contact area with the floater.

The communicating hole may have a non-contact section between the communicating hole and the floater such that the additive container partially communicates with the main body at a falling location of the floater.

The additive container may include a convergent part forming an inclination surface that converges to the communicating hole such that a component with the additive dissolved therein is guided to the communicating hole together with the solvent.

The communicating hole may be formed in plurality.

The additive may be an anti-scale agent.

The anti-scale agent may include hydroxy etylene diphosphonic acid (HEDP).

The anti-scale agent may include ethylenediaminetetraacetec acid (EDTA).

The additive may have a specific gravity larger than the solvent.

According to another aspect of the present application, there is provided a laundry treatment machine comprising: a spray apparatus for spraying a solvent; and an additive injection apparatus for injecting an additive into the solvent supplied to the spray apparatus, and wherein the additive injection apparatus comprises: a main body disposed on a path along which the solvent flows and comprising an inlet and an outlet for receiving and discharging the solvent, respectively; an additive container holding the additive; a nozzle having a communicating hole for communicating between the main body and the additive container; and a floater disposed in the main body and rising and falling according to the flow of the solvent to open and close the communicating hole.

The spray apparatus may include: a flow passage forming unit comprising an inlet receiving the solvent passing the additive injection apparatus, an outlet discharging the solvent, and a flow passage guiding the solvent from the inlet to the outlet; a steam generating heater applying heat to the solvent moving along the flow passage forming unit; and a nozzle connected to the outlet to spray steam generated by heating of the steam generating heater together with the liquefied solvent.

The additive container may hold an anti-scale agent.

Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is

within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. An additive injection apparatus for a laundry treating machine, comprising:

a main body disposed on a path along which a solvent flows and including an inlet and an outlet for receiving and discharging the solvent, respectively;

an additive container, disposed underneath the main body, for holding an additive;

a communicating element for communicating between the main body and the additive container; and

a floater disposed in the main body, the floater to rise according to the flow of the solvent to open the communicating element, and the floater to fall according to the flow of the solvent to close the communicating element,

wherein the floater is configured to be raised, by the flow of the solvent, from the inlet to the outlet to allow the communication element to be opened.

2. The additive injection apparatus of claim **1**, wherein the floater has a specific gravity greater than water.

3. The additive injection apparatus of claim **1**, wherein the communicating element includes a nozzle, and wherein the nozzle includes a communication hole and an inclination toward the communicating hole such that the floater is urged toward the communicating hole.

4. The additive injection apparatus of claim **3**, wherein the floater has a spherical shape, and the communicating hole is non-circular to reduce a contact area with the floater.

5. The additive injection apparatus of claim **3**, wherein the communicating hole has a non-contact section with the floater such that the additive container is in communication with the main body.

6. The additive injection apparatus of claim **3**, wherein the nozzle includes a further inclination that converges upward to the communicating hole.

7. The additive injection apparatus of claim **3**, wherein the communicating hole is formed in plurality.

8. The additive injection apparatus of claim **1**, wherein the additive has a specific gravity greater than water.

9. The additive injection apparatus of claim **1**, wherein the inlet is arranged lower than the outlet.

10. A laundry treatment machine comprising:

a spray apparatus for spraying a solvent into a drum; and

the additive injection apparatus according to any of preceding claims **1-9**.

11. The laundry treatment machine of claim **10**, wherein the spray apparatus comprises:

a flow passage forming unit including an inlet for receiving the solvent passing the additive injection apparatus, an outlet for discharging the solvent, and a flow passage for guiding the solvent from the inlet to the outlet;

a steam generating heater configured for applying heat to the solvent moving along the flow passage to form stream; and

a nozzle arranged on the outlet to spray the generated steam.

12. An additive injection apparatus for a laundry treating machine, comprising:

a body having an inlet to receive a solvent and having an outlet to discharge the solvent;

an additive container at the body to store an additive;

a communicating element between the body and the additive container; and

a floater in the body to change from a first position to a second position and to open the communicating element when solvent is received in the body via the inlet, and the floater to change from the second position to the first position when the solvent is not received at the inlet.

13. The additive injection apparatus of claim **12**, wherein the floater has a specific gravity greater than the solvent.

14. The additive injection apparatus of claim **12**, wherein the communicating element includes a nozzle, and wherein the nozzle includes a communication hole and a first inclination toward the communicating hole such that the floater is urged toward the communicating hole.

15. The additive injection apparatus of claim **14**, wherein the floater has a spherical shape, and the communicating hole is non-circular to reduce a contact area with the floater.

16. The additive injection apparatus of claim **14**, wherein the communicating hole has a non-contact section with the floater such that the additive container is in communication with the body.

17. The additive injection apparatus of claim **14**, wherein the nozzle includes a second inclination that converges upward to the communicating hole.

18. The additive injection apparatus of claim **14**, wherein the communicating hole is provided in plurality.

19. The additive injection apparatus of claim **12**, wherein the additive has a specific gravity greater than water.

20. The additive injection apparatus of claim **12**, wherein the inlet is arranged lower than the outlet.

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